(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
24 October 2002 (24.10.2002)

PCT

(10) International Publication Number
WO 02/083011 A1

(51) International Patent Classification[7]: A61B 17/22, A61F 2/06

(21) International Application Number: PCT/US02/11806

(22) International Filing Date: 10 April 2002 (10.04.2002)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
09/836,957 17 April 2001 (17.04.2001) US

(71) Applicant: **SCIMED LIFE SYSTEMS, INC.** [US/US]; One Scimed Place, Maple Grove, MN 55311-1566 (US).

(72) Inventors: **LAFONTAINE, Daniel, M.**; 1400-5th Avenue North, Plymouth, MN 55441 (US). **LAUNDROCHE, Kurt, M.**; 14711 - 64th Avenue SE, Snohomish, WA 98290 (US).

(74) Agent: **STALLMAN, Brandon, C.**; Christensen O Connor Johnson & Kindness PLLC, 1420 Fifth Avenue, Suite 2800, Seattle, WA 98101 (US).

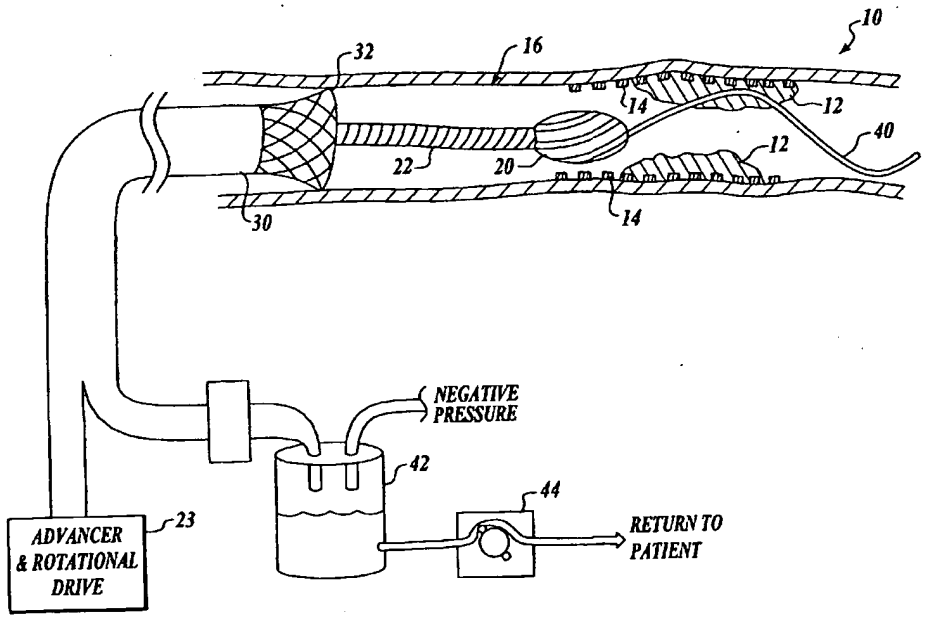
(81) Designated States *(national)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, OM, PH, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TN, TR, TT, TZ, UA, UG, UZ, VN, YU, ZA, ZM, ZW.

(84) Designated States *(regional)*: ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:
— *with international search report*

[Continued on next page]

(54) Title: IN-STENT ABLATIVE TOOL



(57) Abstract: A system (10) for removing matter from a partially or totally occluded stent includes a cutter (20) that is urged radially outward toward the inner surface of the stent. Preferably, the cutter has a hardness that is less than or equal to the hardness of the material used to make the stent. Aspiration may be provided to remove portions of the occluding material from the vessel.

WO 02/083011 A1

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

IN-STENT ABLATIVE TOOL

FIELD OF THE INVENTION

The present invention relates to medical devices in general, and in particular, to rotational atherectomy devices.

BACKGROUND OF THE INVENTION

One of the most common types of vascular diseases afflicting Americans today involves the narrowing of blood vessels by plaque or other materials. Left untreated, such narrowed vessels can contribute to high blood pressure, strokes, or cardiac arrest.

One of the most common techniques for treating a fully or partially blocked vessel is to bypass the blockage with a healthy vessel obtained from elsewhere in the body. A less traumatic approach involves the insertion of a balloon angioplasty device into the vessel and expanding the balloon to compress the occlusion against the vessel wall. Another minimally invasive technique is an atherectomy procedure, where a high-speed cutting device such as the Rotoblator™, produced by SCIMED Life Systems, Inc., the U.S. assignee of the present invention, is inserted into the vessel and advances against the occlusion in order to grind it into small particles that are passed by the body.

In many instances, a physician will place a stent in the area of the treated occlusion. In the case of balloon angioplasty, stents operate to prevent the compressed occlusion from springing back to its former size. For vessels that have undergone an atherectomy procedure, the stent helps maintain an open passage or lumen through the vessel.

Regardless of the procedure used, a fair percentage of stents become re-occluded within a relatively short period of time. However, the material that occludes the stent is somewhat different from the occluding material that blocked the vessel in the first instance. Therefore, techniques used to treat an original occlusion are not believed to be as effective when treating a re-occluded stent. Therefore, there is a need for a device and method of effectively treating re-occluded stents in a manner that does minimal or no damage to the stent itself.

SUMMARY OF THE INVENTION

The present invention is a system and method for removing occluding material from a stent that is positioned within a vessel. In one embodiment of the invention, a

rotational cutter is made of a material having a hardness less than or equal to the hardness of the material used to make the stent. The cutter has a number of recessed blades such that the outer surface of the cutter is relatively smooth and cutting is limited to tissue that enters channels in which the blades are placed. The cutter is preferably routed on a guide wire that is shaped such that the cutter is pressed radially outward against the inner surface of the stent. To aid in the removal of ablated material that is cut from the stent, an aspiration system including a catheter coupled to a source of negative pressure operates to aspirate ablated particles.

In another embodiment of the invention, a cutting mechanism includes a catheter with a self-expanding stent on the distal end thereof. One or more knives are secured to the stent such that the knives are pushed radially outward by the stent. Once the expanding stent is positioned in an occluded stent, the one or more knives are extended and rotated to remove occluding material. Ablated material from the occluded stent is preferably aspirated from the vessel.

In another embodiment of the invention, a cutting mechanism includes a helically-wound cutter that surrounds an inflatable balloon. The balloon is inflated to urge the cutter radially outward against the inner wall of the stent. Ablated particles removed from the stent are preferably aspirated from the vessel.

BRIEF DESCRIPTION OF THE DRAWINGS

The foregoing aspects and many of the attendant advantages of this invention will become more readily appreciated as the same become better understood by reference to the following detailed description, when taken in conjunction with the accompanying drawings, wherein:

FIGURE 1 shows a system for removing material from an occluded stent in accordance with one embodiment of the present invention;

FIGURES 2 and 3 illustrate a cutter in accordance with another aspect of the present invention;

FIGURE 4 illustrates a cutter for removing material from an occluded stent in accordance with yet another embodiment of the present invention;

FIGURE 5 illustrates a helical cutter in accordance with another aspect of the present invention;

FIGURES 5A-5C illustrate various embodiments of helical cutters in accordance with other aspects of the present invention; and

FIGURE 6 illustrates a system for operating the helical cutter in accordance with another aspect of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

FIGURE 1 illustrates one embodiment of a system 10 for removing occluding matter 12 from a stent 14 that is positioned within a vessel 16 according to the present invention. As indicated above, the occluding material 12 is typically different from the occluding material generally associated with arteriosclerosis or other vascular diseases. Once the stent 14 is positioned in the vessel 12, the material 12 that re-occludes the stent is typically a smooth-celled growth that may continue to grow until the lumen or passage through the stent 14 is totally blocked.

To remove the occluding material 12 from the stent, the present invention includes a cutter 20 that is rotated by a drive shaft 22. The drive shaft 22 is advanced and rotated by an advancer/rotational drive 23 at the maximal end of the drive shaft 22. The cutter 20 and the drive shaft 22 are routed within a catheter 30 that is coupled to a source of negative pressure to provide a corresponding negative pressure or slight vacuum within the vessel 16 at the location of the stent. The catheter 30 may have a mechanism for sealing the catheter within the vessel such as a self-expanding stent 32 that is covered with an elastomeric coating such that when the stent 32 expands, the vessel is sealed. Alternatively, inflatable balloons at the end of the catheter 30 or other mechanisms may be used to seal the vessel in order to provide proper aspiration of the ablated particles.

To ensure that the cutter 20 clears a passage with a fairly large diameter, the cutter 20 is preferably routed over a guide wire 40 that is helical or otherwise shaped to force the cutter 20 toward the inner surface of the stent 14 when the cutter is advanced over the guide wire.

In some instances, it may be desirable to deliver a saline solution or other liquid through the drive shaft 22 and/or the cutter 20 to provide additional liquid volume in the vessel so that the vessel 16 doesn't collapse during aspiration. Saline and blood aspirated from the vessel are received in a collecting jar 42 and returned by a pump 44 to the patient via an intravenous drip or other mechanism.

In order to prevent damage to the stent, the cutter 20 as shown in FIGURE 2 is preferably made of a material that is soft or softer than the material from which the stent is made. Typically, the stent 14 is made is made of Nitinol™ or stainless steel. Therefore, the cutter 20 is preferably made of a material having a hardness less than or equal to Nitinol™ or stainless steel. As shown in FIGURE 3, the cutter 20 has a number of recessed blades 50 that lie within corresponding channels 52. The blades 50 are positioned such that the outer surface of the cutter 20 is relatively smooth and will not catch or cut the inner surface of the stent 14. However, any occluding matter 12 that enters or is forced into the channels 52 is cut by the one or more blades 50 as the cutter 20 is rotated by the drive shaft 22. The channels 52 may be spiralled around the outer surface of the cutter 20 in order to force ablated material proximally as the burr is rotated in order to aid aspiration of the ablated tissue.

FIGURE 4 shows an alternative embodiment of a system for removing occluding matter from a stent. Here, a stent 60 is positioned within a vessel 62. The stent is shown as being fully blocked by occluding material 64. To remove the occluding material 64, a catheter 70 is inserted into the vessel. The catheter 70 has a self-expanding stent 72 at its distal end that is preferably covered with an elastomeric or other non-porous material 74 to seal the vessel when the stent 72 expands. One or more extendable cutting knives or blades 76, 77 are secured to the stent 72 such that when the stent is expanded, the one or more knives 76 are urged radially outward toward the vessel wall. In operation, the catheter 70 can be placed within or adjacent to the occluded stent 60. The self-expanding stent 72 is allowed to expand such that the one or more knives 76, 77 are positioned within the stent 60. Thereafter, the catheter 70, self-expanding stent 72, and one or more cutting knives 76, 77 are rotated within the stent to remove portions of the occluding matter 64. Aspiration can be applied to the catheter 70 to remove portions of the occluding material that are cut by the one or more cutting knives 76, 77.

To further hold the catheter 70 in position within the stent, a guide wire 80 has one or more hooks 82 (that may or may not be barbed) at its distal end that can be implanted into the occluding matter 64. The guide wire 80 serves an anchor against which the catheter 70 can be pulled in order to advance the one or more cutting knives 76, 77 within the occluded stent 60. Once the one or more cutting knives 76, 77 are rotated

360° in the stent 60, the guide wire 80 can be further advanced into the occluding material 64 and the process repeated.

FIGURE 5 shows yet another alternative embodiment of a system for removing occluding matter from a stent in accordance with the present invention. In this embodiment, a helical cutter 90 extends around a guide wire 92 that is routed within a catheter 94. The cutter 90 extends from the end of the catheter 94 to a distal bearing 96 that is positioned on the guide wire 92. Within the helical cutter 90 is a balloon 98. The balloon 98 can be inflated with the saline or other material that is delivered through the catheter 94. Preferably, the catheter 94 is sealed along its length to prevent loss of the material used to inflate the balloon. Inflating the balloon 98 urges the helical cutter 90 radially outward toward the inner surface of a stent.

FIGURES 5A-5C show three of many possible embodiments of the helical cutter 90. The helical cutter 90 can comprise a generally round wire 100 that is selectively coated with an abrasive material such as diamond grit 102 as shown in FIGURE 5A. The diamond grit is plated to a wire selectively such that the grit is not exposed on the surfaces that contact the stent itself, if the plated wire momentarily engages the stent, but only cuts deformable restenosis tissue that deforms in the abrasive.

Alternatively, as shown in FIGURE 5B, the helical cutter 90 can comprise a relatively flat spring 104 having an outer edge 106 that is sharpened to provide a cutting surface. The material used to make the flat spring 104 preferably has a hardness that is less than or equal to the hardness of the material used to make the stent to be cleared.

Alternatively, as shown in FIGURE 5C, the helical cutter 90 can comprise a cutaway tube, such as a hypotube, having a sharpened outer edge 110. The tube is wound into a helical coil around the guide wire. The material used to make the tube should have a hardness less or equal to the hardness of the material used to make the stent.

FIGURE 6 shows how a helical cutter 90 of a type shown in FIGURE 5 is used within a vessel. The helical cutter 90 is positioned within a partially or totally occluded stent 120 that is within a vessel 122. A catheter 130 is advanced into the vessel 122 and a sealing mechanism such as one or more balloons 134 at the distal end of the catheter is used to seal the vessel. A catheter 94 that contains the helical cutter 90 is then advanced through the catheter 94. The helical cutter 90 is expanded radially outward once it is within the stent 120 by inflating the balloon 98. The catheter 94 is then rotated by a

prime mover such as gas turbine or an electric motor (not shown) at the proximal end of the catheters 94 and 130. Rotation of the helical cutter 90 removes the occluding material 124 from the stent 120. In addition, aspiration can be provided to the catheter 130 and/or 94 to remove portions of the ablated, occluding material 124. The aspirated material can be removed from the vessel using a pump 140 and a filter 144 before the aspirated liquid is returned to the patient.

While the preferred embodiment of the invention has been illustrated and described, it will be appreciated that various changes can be made therein without departing from the spirit and scope of the invention. It is therefore intended that the scope of the invention be determined from the following claims and equivalents thereto.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. A system for removing deposits from a partially or totally occluded stent, comprising:

a cutter that is insertable in the stent and when rotated removes deposits from the partially or totally occluded stent; and

means for urging the cutter radially outward toward the inner wall of the stent when the cutter is within the stent.

2. The system of Claim 1, wherein the means for urging the cutter radially outward comprises:

a guide wire over which the cutter is passed, wherein the guide wire has a shape that urges the cutter toward the inner wall of the stent.

3. The system of Claim 1, wherein the means for urging the cutter radially outward comprises:

an expandable stent secured to the cutter that pushes the cutter radially outward when the expandable stent expands in a vessel.

4. The system of Claim 1, wherein the means for urging the cutter radially outward comprises:

an inflatable balloon that, when inflated, urges the cutter toward the inner wall of the stent.

5. A system for removing deposits from a partially or totally occluded stent, comprising:

a cutter having a hardness less than or equal to a hardness of the stent, the cutter having one or more recessed blades within one or more channels on the surface of the cutter to cut occluding matter that enters the recesses; and

a guide wire having a shape that directs the cutter radially outward toward an inner wall of the stent as the cutter is passed over it.

6. A system for removing deposits from a partially or totally occluded stent, comprising:

a catheter having an expandable stent at its distal end; and

one or more cutting blades secured to an edge of the expandable stent, the cutting blade having a hardness that is less than or equal to the hardness of the occluded stent;

wherein the expandable stent is expandable within the occluded stent such that the one or more cutting blades are urged toward an inner wall of the occluded stent and wherein the catheter and one or more cutting blades are rotatable to remove an occlusion from the occluded stent.

7. A system for removing deposits from a partially or totally occluded stent, comprising:

an expandable cutter disposed over a guide wire; and

a balloon that expands to urge the cutter radially outward, wherein the balloon is inflated when the cutter is within the occluded stent to urge the cutter toward an inner wall of the occluded stent, the expandable cutter being rotatable in the occluded stent to remove occluding matter.

8. The system of Claim 7, wherein the expandable cutter is a diamond coated helical wire.

9. The system of Claim 7, wherein the expandable cutter is a flat spring having a sharpened outer edge.

10. The system of Claim 7, wherein the expandable cutter is a semi-cylindrical wire having a sharpened edge.

11. A method for removing restenotic tissue from within a stent, comprising:

advancing a cutter into the stent, the cutter including means for preventing damage to the stent;

rotating the cutter; and

aspirating ablated particles of the restenotic tissue.

12. The method of Claim 11, wherein the cutter is a rotating cutter and the means for preventing damage to the stent includes a number of recessed cutting blades.

13. The method of Claim 11, wherein the cutter is one or more blades; and the means for preventing a hardness of the one or more blade(s) that is less than the hardness of the stent.

14. The method of Claim 11, wherein the cutter is an expandable coil and the means for preventing damage to the stent comprise a cutting surface that does not contact the stent.

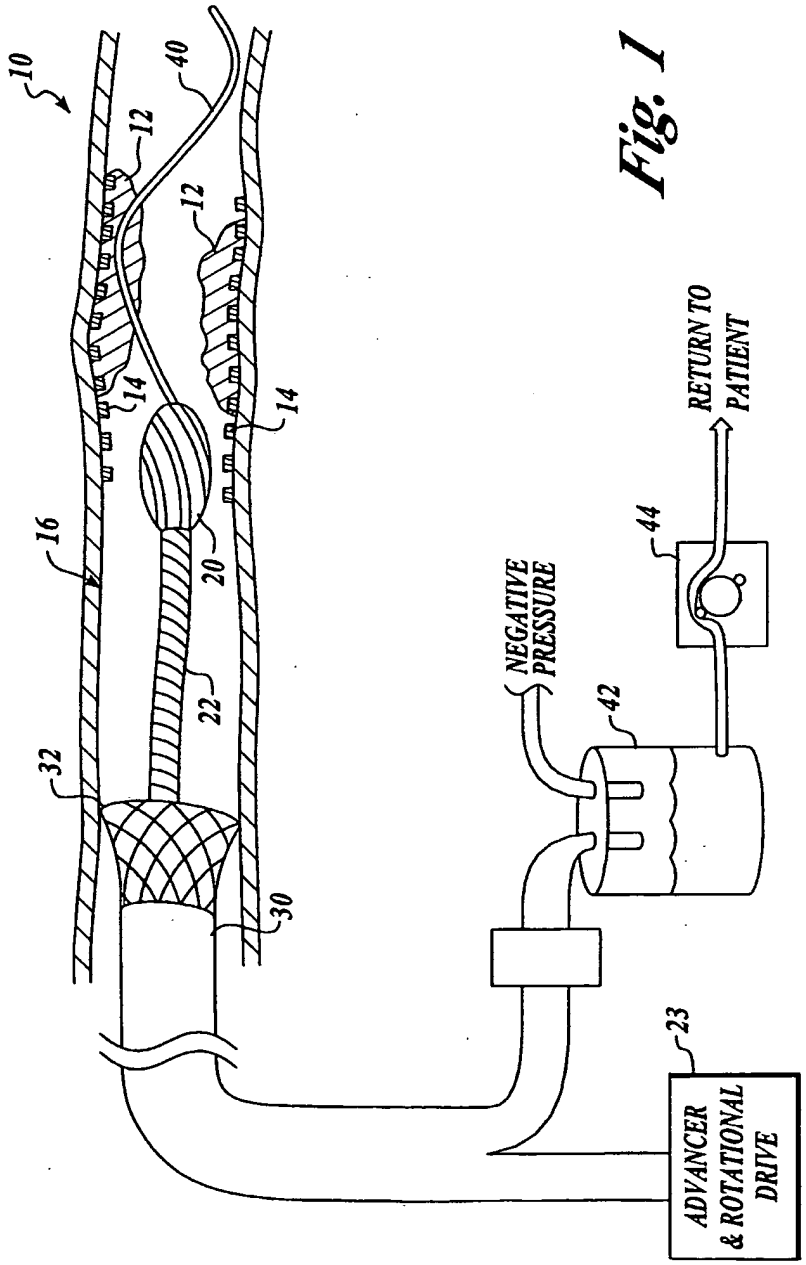

10
12
40
12
14
14
16
20
22
32
30
NEGATIVE PRESSURE
42
44
RETURN TO PATIENT
23
ADVANCER & ROTATIONAL DRIVE

Fig. 1

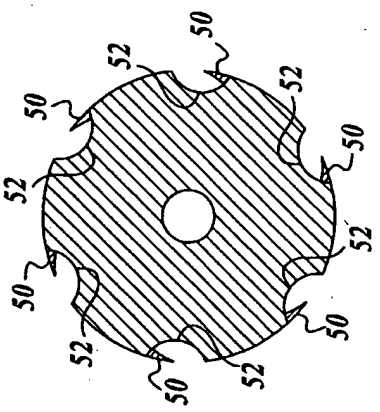


Fig. 3

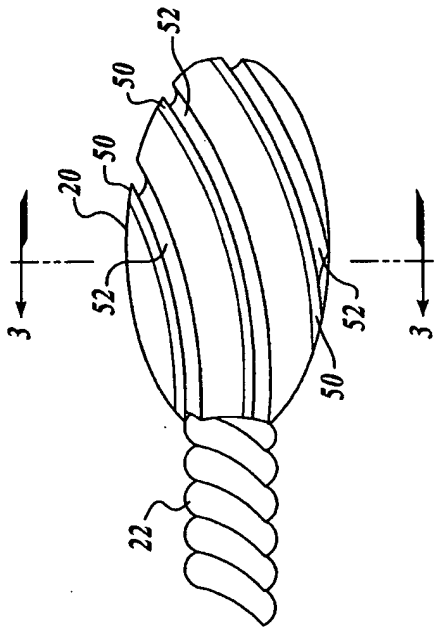


Fig. 2

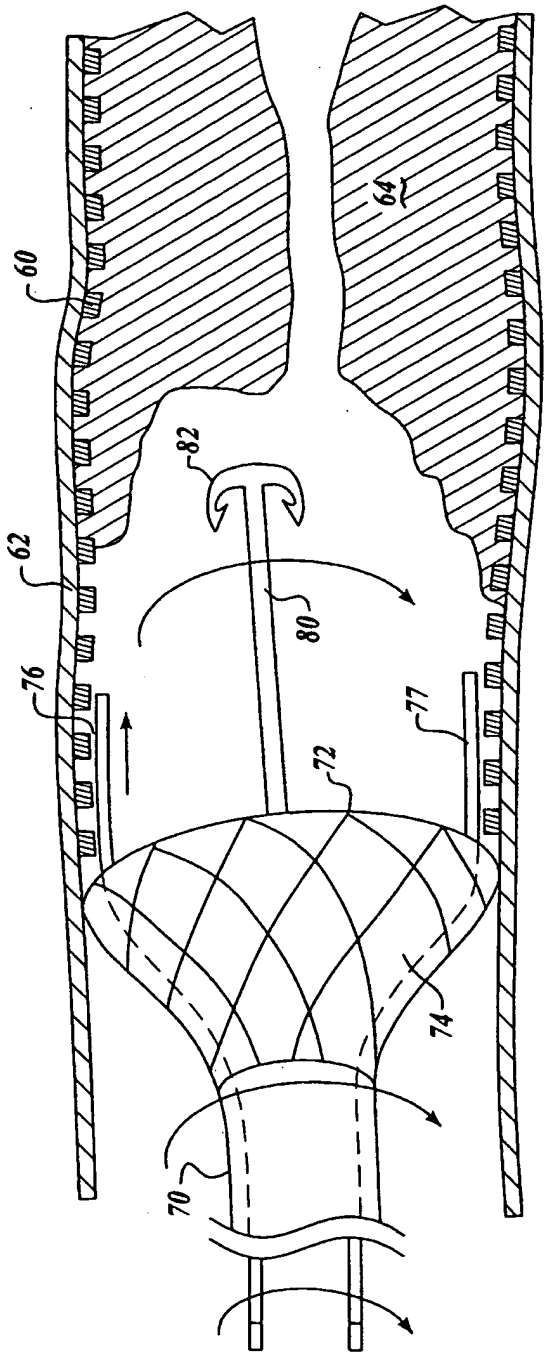


Fig. 4

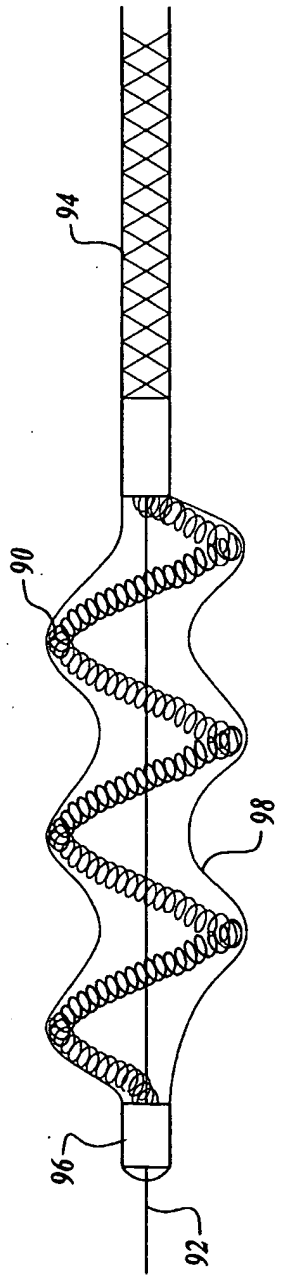


Fig. 5

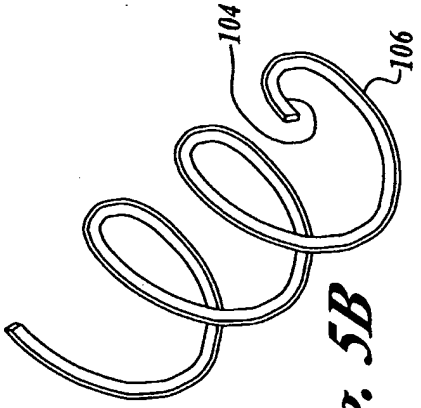


Fig. 5B

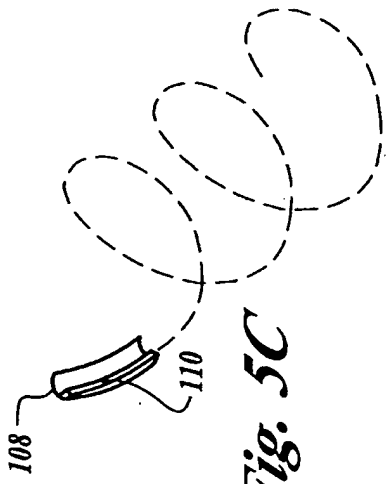


Fig. 5C

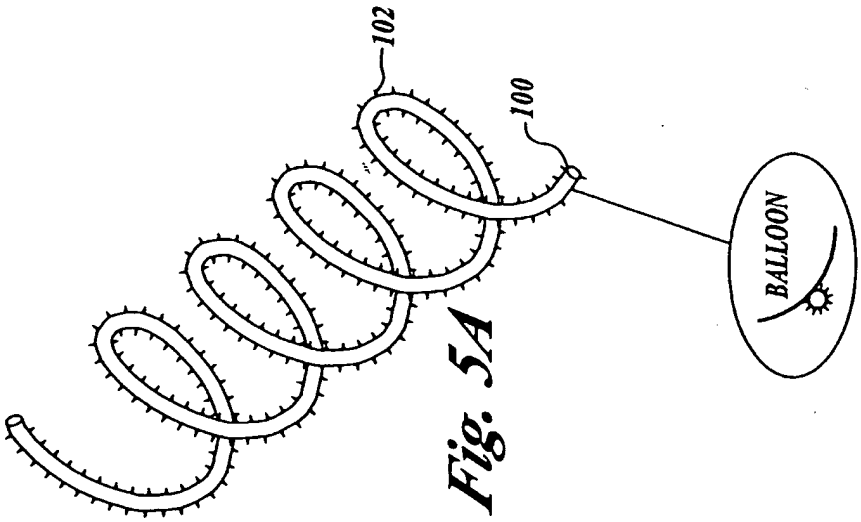


Fig. 5A

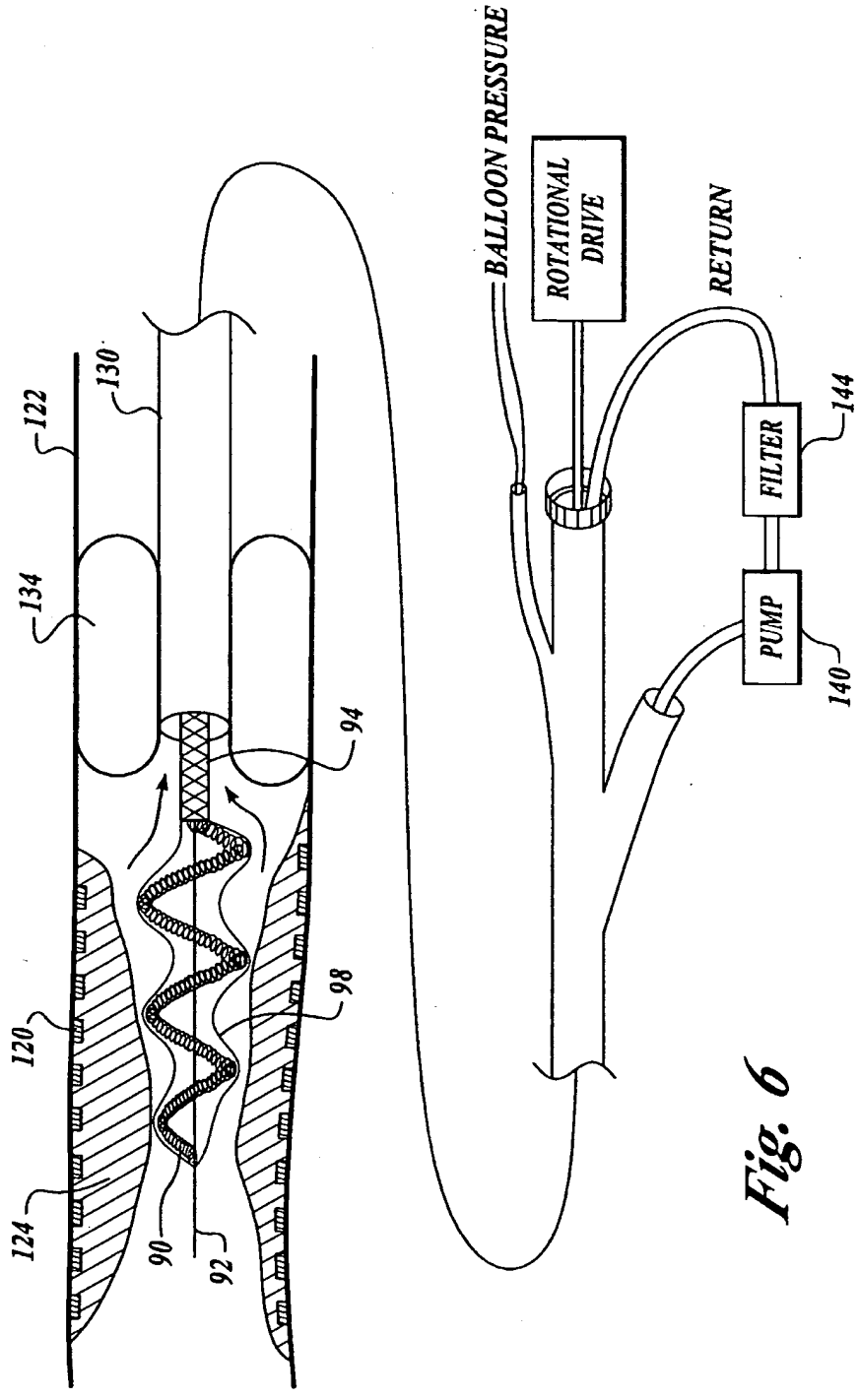

BALLOON PRESSURE
ROTATIONAL DRIVE
RETURN
FILTER
PUMP
144
140
130
122
134
94
98
120
124
90
92

Fig. 6

INTERNATIONAL SEARCH REPORT

International Application No
PCT/US 02/11806

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 A61B17/22 A61F2/06

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 A61B A61F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 99 23958 A (PROLIFIX MEDICAL INC) 20 May 1999 (1999-05-20)	1,2
A	page 5, line 5-21 page 6, line 3-22 page 8, line 12-26 page 17, line 4-11 page 22, line 5-17 page 23, line 3-11 page 30, line 1-5 figures 9C,10H	5

	-/--	

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
24 July 2002	05/08/2002

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Bichlmayer, K-P

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

International Application No
PCT/US 02/11806

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
X	US 5 941 869 A (WILLIAMS G RONALD ET AL) 24 August 1999 (1999-08-24)	1,2
Y		4,7
A		8,10
	abstract column 3, line 23 -column 4, line 30 column 7, line 51 -column 8, line 14 column 9, line 64 -column 10, line 28 column 14, line 55-61 column 16, line 29-54 column 20, line 6-30 figures 1,2,7,16,37,38	

X	US 5 356 418 A (SHTURMAN LEONID) 18 October 1994 (1994-10-18)	1,2
A	figures 1-4 column 4, line 4 -column 5, line 9 column 6, line 22-43 column 10, line 59-65	5

X	US 5 882 329 A (WILLIAMS G RONALD ET AL) 16 March 1999 (1999-03-16)	1,2
A	abstract figure 14 column 2, line 9-16 column 3, line 1 -column 6, line 15 column 9, line 1 -column 10, line 25	5,6

Y	US 5 314 438 A (SHTURMAN LEONID) 24 May 1994 (1994-05-24)	8
A	figures 1,3,4 column 9, line 22-26 claim 37	3

X	EP 0 533 511 A (SCHMITZ RODE THOMAS) 24 March 1993 (1993-03-24)	7
Y	column 2, line 10-39 column 4, line 29,30 column 6, line 27-35 figures 1-3,5	4,8-10

Y	US 4 030 503 A (CLARK III WILLIAM T) 21 June 1977 (1977-06-21) figures 2,4 column 1, line 47-55	9,10

Y	US 5 320 634 A (BARATH PETER ET AL) 14 June 1994 (1994-06-14) figures 1,4A,4B column 2, line 20-29	7

INTERNATIONAL SEARCH REPORT

ernational application No.
PCT/US 02/11806

Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. [X] Claims Nos.: 11-14
because they relate to subject matter not required to be searched by this Authority, namely:

Rule 39.1(iv) PCT - Method for treatment of the human or animal body by surgery

2. [ ] Claims Nos.:
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:

3. [ ] Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

1. [ ] As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.

2. [ ] As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.

3. [ ] As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:

4. [ ] No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

[ ] The additional search fees were accompanied by the applicant's protest.

[ ] No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
PCT/US 02/11806

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 9923958 A	20-05-1999	US 6156046 A	05-12-2000
		CA 2309428 A1	20-05-1999
		EP 1030610 A1	30-08-2000
		JP 2001522631 T	20-11-2001
		WO 9923958 A1	20-05-1999
		US 6139557 A	31-10-2000
		US 6371928 B1	16-04-2002
		US 2002032391 A1	14-03-2002
		AU 3491499 A	01-11-1999
		CA 2327255 A1	21-10-1999
		EP 1069858 A1	24-01-2001
		JP 2002511292 T	16-04-2002
		WO 9952421 A1	21-10-1999
		US 6406442 B1	18-06-2002
US 5941869 A	24-08-1999	US 5882329 A	16-03-1999
		AU 6657098 A	26-08-1998
		EP 1007139 A1	14-06-2000
		JP 2001512334 T	21-08-2001
		WO 9834673 A1	13-08-1998
		US 6319242 B1	20-11-2001
		US 2002016624 A1	07-02-2002
		AU 6170098 A	26-08-1998
		CA 2251341 A1	13-08-1998
		EP 0921841 A1	16-06-1999
		JP 2000508954 T	18-07-2000
		WO 9834674 A1	13-08-1998
		US 5902263 A	11-05-1999
US 5356418 A	18-10-1994	AU 5295093 A	24-05-1994
		WO 9409709 A1	11-05-1994
		US 5360432 A	01-11-1994
US 5882329 A	16-03-1999	AU 6170098 A	26-08-1998
		AU 6657098 A	26-08-1998
		CA 2251341 A1	13-08-1998
		EP 0921841 A1	16-06-1999
		EP 1007139 A1	14-06-2000
		JP 2001512334 T	21-08-2001
		JP 2000508954 T	18-07-2000
		WO 9834673 A1	13-08-1998
		WO 9834674 A1	13-08-1998
		US 6319242 B1	20-11-2001
		US 2002016624 A1	07-02-2002
		US 5941869 A	24-08-1999
		US 5902263 A	11-05-1999
US 5314438 A	24-05-1994	US 5360432 A	01-11-1994
		AU 5956194 A	29-08-1994
		CA 2155187 A1	18-08-1994
		EP 0746244 A1	11-12-1996
		JP 8509390 T	08-10-1996
		WO 9417739 A1	18-08-1994
		AU 5955194 A	04-07-1994
		WO 9413217 A1	23-06-1994
EP 0533511 A	24-03-1993	DE 9109006 U1	10-10-1991
		EP 0533511 A1	24-03-1993

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
PCT/US 02/11806

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 4030503 A	21-06-1977	NONE	
US 5320634 A	14-06-1994	US 5196024 A	23-03-1993
		AU 2631392 A	21-10-1993
		CA 2080866 A1	18-10-1993
		DE 69219878 D1	26-06-1997
		DE 69219878 T2	16-10-1997
		EP 0565796 A1	20-10-1993
		ES 2103898 T3	01-10-1997
		JP 2591573 B2	19-03-1997
		JP 5293176 A	09-11-1993
		US 5616149 A	01-04-1997